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Teacher Concerns During Initial Implementation of a One-to-One Laptop Initiative at the Middle School Level

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Abstract

Many schools are initiating projects that place laptop computers into the hands of each student and teacher in the school. These projects entail a great deal of planning and investment by all involved. The teachers in these schools are faced with significant challenges as they prepare for teaching in classrooms where every student has a computer. Using the Concerns-Based Adoption Model of change, this study investigated the concerns of teachers in the early stages of a one-to-one laptop initiative. The results of the study indicate that teachers fall into two relatively well-defined categories in terms of their concerns regarding the innovation. The majority of teachers have genuine concerns about how the introduction of laptop computers into the school environment will impact them personally. A lesser number have concerns about how they will be able to best use the laptops to meet the needs of the students. Implications for professional development include differentiating training based on teacher concerns, ensuring teachers have a voice in the process and are well-informed of decisions pertaining to the adoption, and implementation of the innovation.

INTRODUCTION

At a time of nationwide emphasis on school improvement, the role of educational technology continues to be a much-debated topic at the school, district, state, and national levels. While some would argue that the introduction of technology into schools changed education, others would suggest that the appearance of the classroom changed, but many of the activities remain the same (Cuban, 2002; Richardson & Placier, 2001; Sandholtz, Ringstaff & Dwyer, 1997; Tyack, & Cuban, 2000).

One-to-one laptop programs are being initiated with ever increasing frequency in K–12 schools in the United States and abroad. These represent significant investments that necessitate substantial evaluation of the rationale, goals and outcomes of each initiative. A number of these initiatives have been reported upon and have provided useful information regarding goals and outcome data such as student achievement, attendance and attitudes (see for example, Anderson & Dexter, 2003; Lowther, Ross, & Morrison, 2003; Silvernail & Lane, 2004). However, we know from prior research on innovation adoption that successful implementation is deeply rooted in an understanding of the concerns of the individuals delivering the innovation (Hall & Hord, 2001). The purpose of this study was to examine one-to-one computing access in the middle school setting from the perspective of those being asked to change.

REVIEW OF LITERATURE

After five years of examining the impact of technology in education, the CEO Forum formulated the *School Technology and Readiness Report* (2001). Key findings included: (a) technology can enhance student achievement in many ways; (b) the impact of technology is greatest when integrated into a curriculum that has clear, measurable objectives; (c) assessment is often not aligned with curriculum, nor is it measuring 21st-century skills; and (d) strategies to measure and improve technology integration in education are few and far between (CEO Forum, 2001). These recommendations were echoed by the Partnership for 21st Century Skills (2002). The partnership believes that educators and educational agencies must stress teaching and learning 21st-century content, skills and assessments. The introduction of computers into the teaching and learning experience is in many ways acting as a catalyst for educational change toward a more 21st-century learning environment.

One-to-One Computing Access

The one-to-one computer access movement began in the 1980s with the Apple Classrooms of Tomorrow (ACOT) project. ACOT was the first large-scale initiative providing one-to-one access to students and teachers in the K–12 setting. By preparing ACOT project classrooms for digital teaching and learning, the project sought to not only examine, but to promote a changing educational context (Sandholtz, Ringstaff, & Dwyer, 1997).

The Instructional Evolution Model that resulted from the ACOT study is particularly relevant to the current study. Based on results of the ACOT study, Sandholtz, Ringstaff, and Dwyer (1997) proposed that innovation adoption is a process in which teachers will gradually change their teaching based on changing comfort levels with the technology. In a review of literature on one-to-one computing, Penuel (2006) reported that in the majority of studies of laptop implementation, teachers are in the adaptation stage in which they are adapting their existing teacher-centered practices to allow for the integration of the laptops into the learning experience of the students. Additionally, studies of professional development for one-to-one computing initiatives (Rockman, 2000; Sandholtz, Ringstaff, & Dwyer, 1997; Silvernail & Lane, 2004; Windschitl & Sahl, 2002; Yang, 2002) reported that staff development must match the current needs of the teachers. In other words, the teacher's current level (or stage) should be a primary consideration when designing and delivering staff development opportunities.

One-to-one computing access initiatives have evolved with the changing technology and aim to implement more portable versions of computers into the learning environment. The Microsoft Anytime Anywhere Learning (AAL) initiative was a large-scale example of this type of one-to-one access providing students and teachers with laptop computers. In 1996, like the ACOT project, Microsoft's AAL initiative helped to establish a foundation and starting point for future one-to-one computing programs. Reported findings from three years of AAL research by an independent evaluation team included enthusiasm for teaching and learning with technology, improved writing skills across all grade levels, a progression of

increasingly authentic and purposeful uses and access to technology, and relevant to this study, a gradual shift toward constructivist pedagogies (Rockman et al., 1997; 1998; 2000).

One-to-one initiatives continue to be implemented across the United States with initial research findings and anecdotal evidence suggesting improved student achievement and overall satisfaction with teaching and learning with laptops. In 2002, Henrico County Public Schools (VA) embarked on the largest scale one-to-one initiative in the United States and provided over 25,000 laptops to teachers and students in grades 6–12. Students and teachers were reported as using the laptops in all subject areas for a variety of reasons. In addition, teachers, students, and families considered the laptops to be a positive addition to the teaching and learning experience with improved student-teacher and school-home interaction, increased student self-directed learning, and enhanced student motivation to learn (Zucker & McGhee, 2005).

In examining existing research on one-to-one laptop initiatives, Apple (2005) reported similar results across many studies. This report compared the impact of different levels of computer access on student outcomes. Benefits of one-to-one access over student-computer ratios of 2:1 and 4:1 included students using computers for a greater variety of purposes and subject areas, improved student writing skill, and enhanced student technology literacy (Apple, 2005). These findings are further echoed by Penuel (2006) in his examination of 30 articles in which laptop computers and wireless Internet access were the focus. Penuel reported that laptop initiatives in the United States and abroad have cited meeting the goal of preparing students for 21st-century citizenship, enhancing computer literacy, and showing positive effects on student writing as support for program implementations.

As the literature reporting positive outcomes of one-to-one computing initiatives continues to become available, a greater influx of this form of educational change will likely result. In order for one-to-one laptop initiatives to be sustained, however, it is crucial that change facilitators are aware of teacher concerns. What often happens is that teachers who are going through the change process are rarely consulted on the usefulness of the innovation, yet they are expected to adopt it with open arms (Richardson & Placier, 2001; Tyack & Cuban, 2000).

PURPOSE OF STUDY

The purpose of this study was to determine teacher concerns during the introduction of a one-to-one computing access initiative in the middle school setting. More specifically, the question guiding this study was: *What are teacher concerns during initial implementation of a one-to-one laptop initiative at the middle school level?*

Results of this study can be used by K–12 teachers, school administrators, teacher educators, and professional developers to gain a better understanding of potential challenges faced during initial adoption of a one-to-one laptop program. Additionally, results of this study may be useful to professional developers to align content and delivery of professional development with teacher concerns.

THEORETICAL FRAMEWORK

This study is grounded in a theoretical framework of educational change. Wiersma (1991) suggested that "conditions under which research is conducted and data obtained within and across studies must be incorporated into a meaningful whole" (p. 19). As a theoretical framework, change theory informs the guiding question of this study. Scholars such as Rogers (1983) have provided invaluable descriptions of the change processes and constructs. Others such as Fullan have provided insight into how these concepts impact educational settings (2001). Additionally, Hall and associates developed a change model that is well suited to address the questions posed here (Hall & Hord, 2001). More specifically, the Concerns-Based Adoption Model (CBAM) provides a theoretical framework as well as the tools with which the study was conducted. Using the CBAM in the current study enabled the research to focus on the key players in the change process—the teachers.

CBAM is unique because it considers change from the perspective of those implementing the innovations (Heck, Stiegelbauer, Hall, & Loucks, 1981). In particular, this study examined the impact of a changing educational context on the teachers. The CBAM model and diagnostic tools will be more completely described in the following section.

METHOD

Participants and Setting

The context of this study is unique for a one-to-one computing initiative. The school site, an urban middle school in the Southwestern United States, was one of several GEAR UP (Gaining Early Awareness and Readiness for Undergraduate Programs) schools in the school district, but the only one at which students were given laptop computers. As part of the GEAR UP involvement, the school received funding for a one-to-one laptop initiative that included funds for teacher training, encouraging parent involvement, and developing more student-centered learning activities through the integration of technology into teaching and learning. Students at the school were reported by teachers and administrators as having little motivation to attend college but having aspirations to work in the service or labor industry. In addition to the students who were the focus of GEAR UP, the school hosted an International Baccalaureate Magnet Program. The students enrolled in the magnet program were not from the surrounding area and were higher achieving and more professional in their attitude toward their education. Nonetheless, the school population was considered at risk in that 84% of students were eligible for free or reduced lunch and a large percentage (55%) of the student population were English language learners.

Class sizes were in alignment with the overall school district ranging between 25 and 28 students in each class. One of the school's goals was to provide an environment of enhanced technology integration to support the preparation of students for the 21st century. All classrooms within the school had Internet access, each classroom had at least one desktop computer, and every teacher had a laptop computer.

Participants for this study were 17 seventh grade teachers (out of a possible 20 who taught core subjects and were in the laptop program) and two building-level administrators. The teacher participants taught the core subjects of history, math, language, reading, and science with several of them teaching in the magnet program as well as the mainstream program. Participants for this study were included on a volunteer basis.

Research Tools

The Concerns-Based Adoption Model provides a research-supported framework to evaluate the concerns of teachers in the early stages of participating in a one-to-one laptop implementation (Hall & Hord, 2001). In particular, principles of change unique to the CBAM relevant to this study include the premise that the individuals within the school are the primary units of change, and teacher attitudes, beliefs, and values influence the change process.

Concerns-Based Adoption Model

The CBAM is a change model in which relationships between users and the resource system of an innovation can be examined. For this study, the resource system consisted of the GEAR UP federal grant program and the school district administration. The users were the teachers and students at the middle school site being studied. School administration can be considered change facilitators, and as the study evolved, the researcher came to be viewed by the teachers as a change facilitator. The three diagnostic tools of the CBAM user system are the Stages of Concern (SoC), Levels of Use (LoU), and Innovation Configurations (IC). This study was one of several conducted at the school site, using the CBAM. In addition to this study, an Innovation Configuration was developed. The SoC dimension of the CBAM is most relevant to this study as it focuses on change during initial innovation adoption from the perspective of the individuals involved in the change, and can be used as a tool for continued examination of the innovation adoption.

The SoC dimension utilizes three data collection tools to identify individual and group concerns about an innovation. Concerns were identified through informal interviews, open-ended concerns statements, and Stages of Concern questionnaires (Hall & Hord, 2001). Once collected, concerns data are represented by seven stages of concern within four levels —unrelated, self, task, and impact (Table 1, page 268).

The *Unrelated* level consists of only one stage, Awareness, in which the individual has no concerns about the innovation. At the opposite end of the continuum, the *Impact* level has three stages and sees the individual progressing from being less concerned about the innovation's impact on them as an individual and being more global in their concerns. Between these levels are the *Self* and *Task* levels. Individuals at the *Self* level (Informational and Personal stages) of concern have not necessarily fully adopted the innovation. Individuals at a *Task* level (Management stage) may be asking themselves about ways to best organize their time to allow for innovation use (Hall & Hord, 2001). Additionally, the individual in a Management stage may have concerns about taking full advantage of resources and materials that are associated with the innovation. In the case of this study, teachers at this stage may be concerned about having enough time to fully explore the potential of using laptop computers to best meet the learning needs of the students.

Table 1: Stages of Concern

Level	Stage of Concern	Description
Unrelated	Awareness	Just beginning to think about the innovation but not concerned about it at all
Self	Informational	Interested, but not concerned beyond curiosity about features of the innovation
	Personal	Concerned about own role in innovation adoption and how it will impact them as an individual
Task	Management	Concerned about how they are using the innovation, how best to find and use resources and how much time and effort is being put into the innovation
Impact	Consequence	Concerned about how the innovation is impacting others (e.g., students and community)
	Collaboration	Concerned about sharing impact of innovation with others in local and global community
	Refocusing	Concerned about modifying or replacing the innovation

Adapted from Hall and Hord's (2001) work

Three tools were employed for identifying concerns during innovation adoption in this study.

Stages of Concern Questionnaire (SoCQ)

The SoCQ is a self-report survey developed by Hall and his associates to understand the feelings and perceptions about change from the individuals involved in the change process. The SoCQ has been tested for reliability (test/retest reliability range from .65–.68) and validity (alpha-coefficients range from .64–.83) (Hall & Hord, 2001). The SoCQ is not focused on the internal factors of the innovation, but is more personal and seeks to determine the concerns of the individual user. Questions directly relate to the stages of concern. For the purpose of this study, the SoCQ was used to determine both individual and group concerns of teachers involved in the initial phase of a one-to-one laptop initiative.

The format of the questionnaire is a series of statements to which the participant responds to the relevance of the statement to them at that time (see appendix). Participants respond by selecting the degree of relevance on an 8-point scale: O indicates irrelevant, 1— *not true of me now*, through to 7—*very true of me now*. Statements that participants respond to vary from *I am not concerned about the innovation* to *I would like to discuss the possibility of using the innovation*. In addition to the 35 Likert-scale type items, the SoCQ used for this study included open-ended questions.

Open-Ended Questions

The open-ended questions of the SoCQ ask the innovation adopter to use complete sentences to describe or share any other concerns they may have at

this time (Hall &Hord, 2001). Where the Likert-scale items are used to create individual concerns profiles, responses to the open-ended questions contribute to the creation of a group concerns profile (Hall & Hord, 2001). Data from the open-ended questions are used to exemplify group concerns by painting a verbal picture of concerns. As recommended by Hall (personal communication, May 5, 2004) the open-ended questions were adapted from the example provided by Hall and Hord (2001). The resulting open-ended questions were: *(1) What other concerns if any do you have at this time*, and (2) *Briefly describe your job function.*

One-Legged Interviews

One-legged interviews are a diagnostic tool of the CBAM for assessing concerns in an informal and non-intimidating manner. The premise of a one-legged interview is that it occurs at an unspecified time and is often little more than a "how's it going?" question. The one-legged interview got its name from the image of two people with only one leg planted on the ground as they pass each other in a corridor or other public space (Hall & Hord, 2001). There is no formal question format and transcripts of interviews are recorded as notes by the change facilitator. Advantages of one-legged interviews include the unobtrusive nature of the research tool and the establishment of a relationship in which the change facilitator can show support for the innovation adopter (Hall & Hord, 2001). For this study, the one-legged interviews were informal conversations during and after observations conducted for the Innovation Configuration study (Donovan, 2005) in which the lead researcher simply chatted with the teachers. For example, "how's your week been?" was a common conversation starter to which teacher participants often began to share some of the challenges or tribulations they had experienced with the laptops over the past few days. Analysis of one-legged interviews follows similar format for analysis of open-ended questions in that patterns are identified and quotes extrapolated. The patterns are then used to add support to the group concerns profiles in the form of examples of specific concerns.

Procedure

Data collection for this study was conducted in two stages. The first stage included the collection of the primary data source for the study, the SoCQ and open-ended questions. The second stage consisted of the informal one-legged interviews conducted throughout the school year.

Stage One: SoCQ and Open-Ended Questions

The SoCQ was administered as an integral part of a teacher training session relative to the laptop initiative. Initial administration was in June 2004 at a paid training for currently employed 7th grade teachers. A second administration was conducted in August 2004 for teachers hired over the summer or those unable to attend the June training.

The survey was administered by one of the researchers during the first day of the paid training. The same procedure was followed at both administrations and will be addressed as one. Teachers attending the trainings were the teachers of the core subjects (history, math, language, reading, and science) only. Teachers of computer

literacy, physical education, special education, library, and foreign language did not attend the trainings and were not participants in this study. Some of the teachers involved in the laptop initiative were unable to attend either training and did not complete the survey. The survey was administered such that participants did not need to identify themselves other than if they chose to in the open-ended question asking them to briefly describe their job function. The researcher was introduced as being affiliated with the local university and the survey was handed to teachers with no time limit set for completion. The researcher remained in the room while teachers completed surveys, and surveys were handed to the researcher upon completion. Teachers took approximately 15 minutes to complete the survey. Administration of the surveys for the school administrators was less formal and entailed the researcher handing the survey to the participants and asking them to complete it. Administrator surveys were not completed immediately, and were collected during a follow-up visit to the school.

Stage Two: One-Legged Interviews

One-legged interviews, as the name implies, were conducted on an impromptu basis by one of the researchers. It should be noted that the current study was one of several concurrent studies at the middle school centering on the laptop initiative, and the researcher was considered a *familiar face* by the teachers. One-legged interviews were more informal conversations about what was going on in the classroom and what the teacher's week had been like. For the administration, one-legged interviews were less frequent and usually began with a question relating to "how's everything going?". In addition to one-legged interviews conducted at the school site, the researcher was a faculty member of the university at which several of the participants were Masters of Education students, so other one-legged interviews were conducted on the university campus. These interviews were usually brief yet often had a more "academic" tone.

Data Analysis

Data for this study were analyzed following the guidelines and recommendations for evaluating concerns (Hall, George, & Rutherford, 1998; Hall & Hord, 2001). First, individual data were entered into a spreadsheet program with participants as columns and survey questions as rows. Second, because each question relates to a specific stage of concern, individual participant's raw data were converted to stage of concern data, and total "points" from the Likert scale items added. For example, questions 3, 12, 21, 23, and 30 all related to stage 0, awareness concerns, and questions 2, 9, 20, 22, and 31 all related to Stage 6 Refocusing concerns. Table 2 is an excerpt from the spreadsheet program used during data analysis. In this excerpt, there are three participants (A, B, C). Rows represent participant's totaled score for each stage. For example, participant A has a total raw score of five in Stage 0 Awareness and a total raw score of 22 in Stage 5, Collaboration.

The next step in developing concerns profiles was to convert raw scores to percentages. A quick scoring table developed by Parker and Griffith (Hall, George et al., 1998, p. 97) was used to convert raw scores to percentages and these data were also entered into the spreadsheet. Table 3 shows the above participant's raw scores converted into percentages. Finally, using the charting feature of the Excel

Table 2: Excerpt from Data Analysis Program

Stage of Concern	Participant's raw scores for each stage of concern		
	Part. A	Part. B	Part. C
0	5	5	11
1	13	9	21
2	14	8	29
3	16	10	31
4	18	15	24
5	22	7	12
6	15	4	8

Table 3: Sample Raw Scores Converted into Percentages

Stage of Concern	Participant's percentage score for each stage of concern		
	Part. A	Part. B	Part. C
0	53	53	84
1	51	40	75
2	55	35	92
3	60	34	98
4	24	16	48
5	55	9	19
6	42	6	17

program, individual concerns profile graphs were created, using the stage of concern for the X-Axis and the percent of concern for the Y-Axis. Additionally, a teacher group profile, an administrator group profile, and a whole group profile were created using the same procedure but using an average of the group's percentage concern data.

RESULTS

A total of 17 seventh grade teachers and two school administrators completed the SoCQ. Two of the teacher SoCQs could not be included in the data analysis because they did not complete the entire survey, omitting a "back side" of the two double-sided pages. Results will be reported in two sections: Teacher concerns group profile and administrator concerns profiles.

Teacher Concerns Group Profile

Teacher concerns group profile represents the concerns of the teachers as a group and not as individuals. The group profile for teachers was examined in two ways. First, individual profiles were examined to determine where individual teachers most intense concerns were. This was determined by recording the highest peaks on the individual concerns graphs. The highest peak represents the

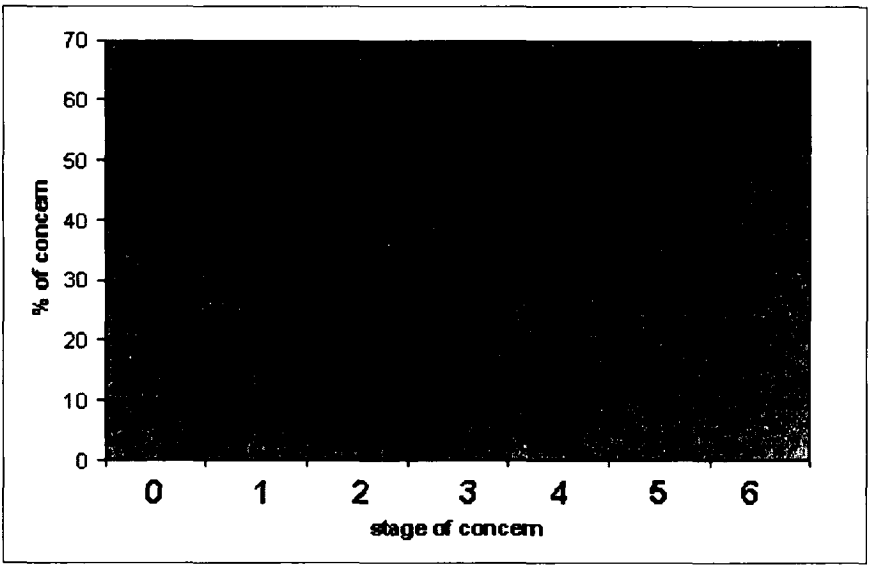

Figure 1. High level Personal, low level Consequence individual concern profile

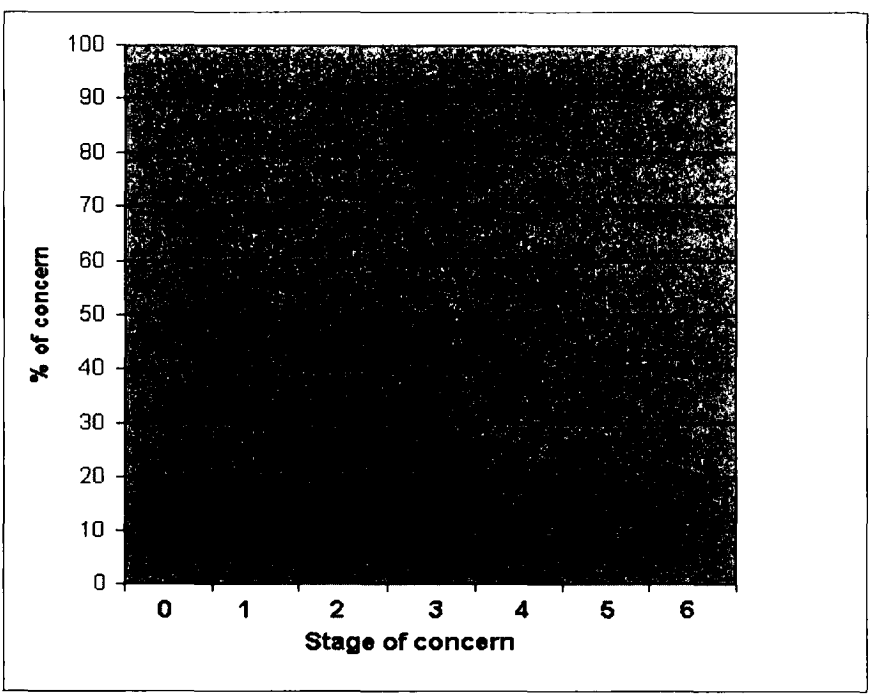

Figure 2. High level Awareness, Personal and Collaboration, low level Consequence individual concern profile

Table 4. Teacher Population Concerns Clusters

Level (Stage of Concern)	% of teachers
Awareness	0
Self (1—Informational)	0
Self (2—Personal)	52
Task (3—Management)	18
Impact (4—Consequence)	5
Impact (5—Collaboration)	23
Impact (6—Refocusing)	5

most intense concerns of the teacher and does not mean they do not have other concerns also.

Figures 1 and 2 represent individual concerns profiles for two of the teacher participants in this study. These graphs are representative of the two most commonly occurring profiles. Figure 1 shows an individual with high Personal concerns (stage 2) and low Consequence concerns (stage 4). Figure 2 also represents concerns of an individual with high Personal concerns (stage 2) and low Consequence concerns (stage 4); however, what is interesting about the teacher concerns represented in Figure 2 is that this teacher also has relatively high level Collaboration concerns (stage 5).

Table 4 shows the percentage of teacher participants whose concerns peaked at each of the different stages. Of the 17 teachers, more than half (52%) of them had intense Self concerns at the Personal stage. An additional 18% had high Task level Management stage concerns and 23% had intense Impact Level, Consequence stage concerns. From Table 4, it is evident that as a population or group, teacher participants in this study cluster around having high intensity Stage 2 Personal concerns.

Teacher concerns can be more fully explored by examining the group concerns profile. Figure 3 (page 274) represents the teacher group concerns profile. Unlike Table 4 in which only the *most intense* concerns were represented, the group concerns profile represents the overall concerns at all levels as averaged across all participants. Concerns for the group peak at Stage 2 Personal concerns, and have a distinct valley at Stage 4 Consequence concerns.

Group personal concerns can be even further understood by looking at data from one-legged interviews and answers to the open-ended questions.

One legged interview and open-ended statement comments confirmed teacher concerns at the Self level Personal stage (stage 2). Comments such as the following are representative of many teachers' Personal concerns about the innovation adoption:

> I'm worried about teaching with the laptops because I don't really know what to do

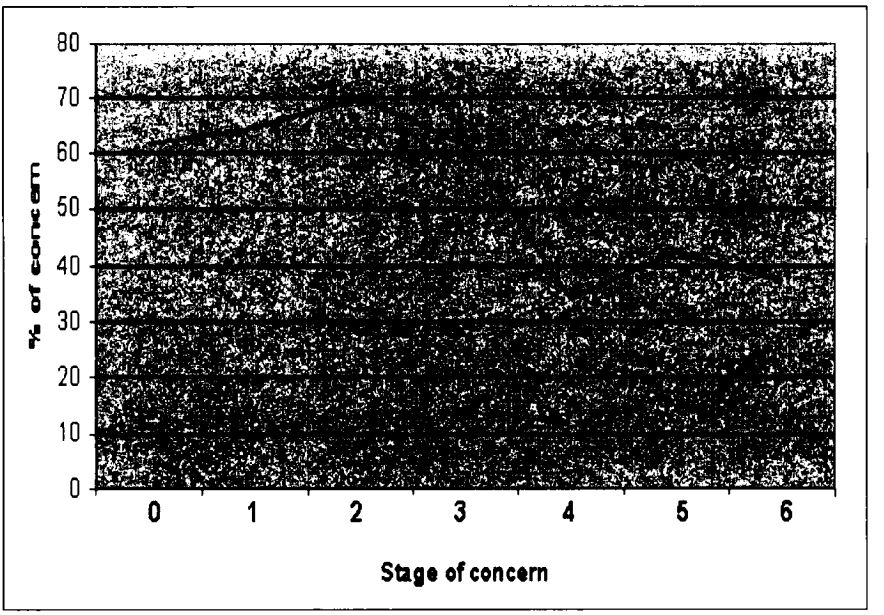

Figure 3. Teacher Group Concerns profile

> You can come and observe me but not today because I'm still working on my plans
>
> I'm concerned with being able to cover all course requirements while being bogged down with the laptops
>
> Teaching our students all the ins and outs of the applications

Other teachers' concerns represented Task level Management stage (stage 3) concerns. Comments from open-ended questions and interviews illustrate these concerns:

> It bothers me that I can't grade assignments and make comments on them and then send them back to the students
>
> It bothers me that I can't use the laptop for attendance because I love the laptop but we have to take attendance on the desktop computer
>
> It bothers me that I can't use the projector with the student laptops

In summary, teacher concerns during the initial stage of the one-to-one laptop initiative were predominantly about the impact the introduction of laptops has on them as an individual in such that they are concerned how it may impact their time, planning, and instructional practices. A smaller percentage of teachers had

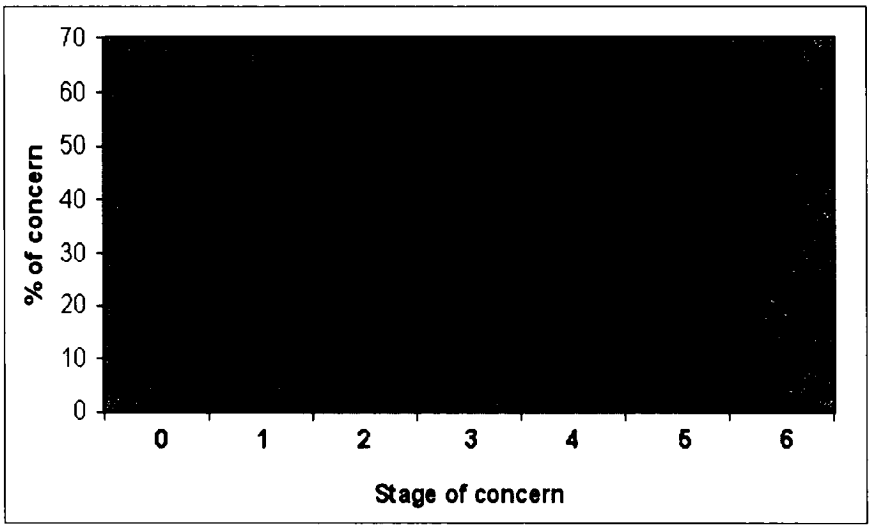

Figure 4. Administrator A's Concerns profile

concerns about how to best use the laptops to promote learning, routines, and teacher effectiveness and how to collaborate with others about the program.

Administrator Group Concerns Profile

Two administrators comprise the administrator group. Administrator A had been involved in the laptop program since the planning stage and Administrator B was new to the school the year this study was conducted. Because the two administrators were at contrastingly different stages of concern they will be addressed as individual concerns profiles rather than as a group. Figure 4 shows Administrator A's concern profile. Concerns of Administrator A peak at both Management and again at Collaboration. Administrator A's biggest concern as described in the open-ended statement was "to be certain that teachers are trained properly for the implementation of the program in grade 7." Additionally, Administrator A expressed concerns during one-legged interviews about sustaining the program for the future and making sure things ran smoothly.

Figure 5 (page 276) shows Administrator B's concern profile. Administrator B has highest Awareness concerns (stage 0) and a small peak at the Management level (stage 3). Open-ended statements for the administrator refer to concerns about maintaining the one-to-one laptop program and ensuring the decision to invest money and modify teaching loads would be reflected in the success of the program. It is also worth noting that while Administrator B was supportive of the project, the relatively high level of Awareness concerns are in part a consequence of this being a project that was started before her arrival.

DISCUSSION

Overview

This study examined teacher and administrator concerns during the initial phase of a one-to-one laptop initiative at an urban at-risk middle school in the

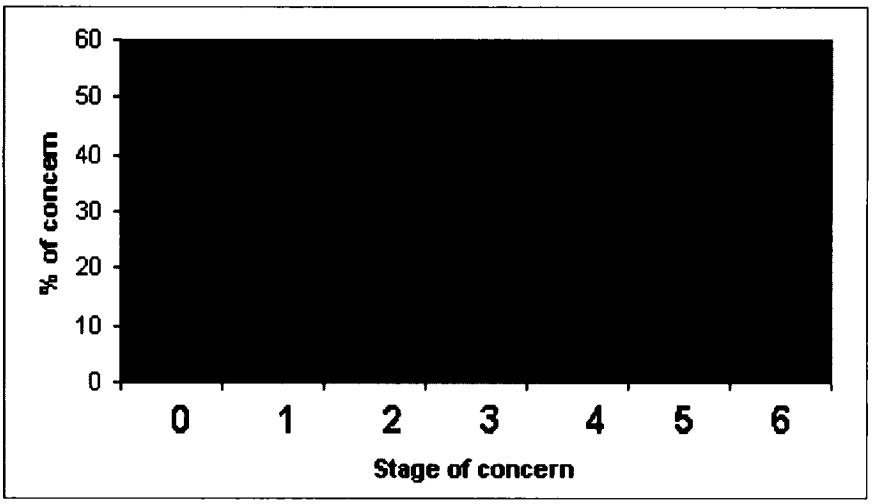

Figure 5. Administrator B's Concerns profile

Southwestern United States. Stages of Concern can be examined by level or by stage. Teacher concerns in this study were at many levels; however, concerns were primarily at the *Self* or *Task* level. Self concerns were at the Personal Stage (stage 2) and Task concerns were at the Management stage (stage 3). As a group, teacher concerns were predominantly about the innovations' impact on them as individuals; however, a smaller percentage of teachers were concerned about the best way to utilize the laptops for maximum teacher effectiveness.

Although teachers at this school were involved in the laptop initiative by choice, (some teachers even requested a change in assignment to be involved) their concerns of involvement in the laptop initiative were genuine. High level Self concerns are typical of teachers anticipating educational change (Hall & Hord, 2001; Newhouse, 2001). Teachers' concerns in the Self stage were reflected by their hesitation to allow the researcher to observe them, their admissions of not feeling comfortable with the laptops for instructional purposes, and their struggle with how to integrate the laptops into their teaching routines.

Results of this study will be discussed by examining concerns profiles, followed by a more detailed discussion of the impact of this study on professional development and program continuation plans at the school. Finally, recommendations for future one-to-one initiatives will be made, and limitations of this study will be addressed.

It was evident in this study that change is a process that is initially discomforting. Teachers' concerns centered on readying themselves for the challenge of teaching in the one-to-one environment, yet when considered in relation to the concerns of the two administrators, we can see stages of concern along the continuum. Administrator B who was the newest to the school and the initiative, exhibited high Awareness concerns indicating a deep desire to learn as much about the program as possible. The teachers whose concerns were predominantly at the Self level (Personal stage) were further along the continuum because they had been involved in the program for longer than Administrator B, yet not long enough to be fully

comfortable with it. Note that several of the teachers had been involved in the pilot program the previous semester and/or were somewhat comfortable with technology as they were pursuing masters degrees in educational technology.

At the beginning of any school year, teachers have concerns about being fully prepared to teach the incoming students. When the introduction of an innovation is added to that, it is not surprising that their concerns are at a Personal stage. High level Informational and Personal concerns could be considered an indicator that teachers had not started or were barely using an innovation (James, Lamb, Householder, & Bailey, 2000). Observations throughout the first year of the laptop initiative (in the concurrent study) revealed that several teachers rarely used the laptops for teaching and learning, once again confirming their concerns about being proficient with the innovation. It was apparent in interviews that teachers did not feel proficient with the technology to integrate it in innovative ways. These teachers more frequently used the technology for functions they were personally comfortable with such as word processing and searching the Internet. Similarly, if an innovation was being fully implemented, concerns would be at a Management stage (James et al., 2000). Not surprisingly, teachers who expressed Management concerns in the one-legged interviews and through open-ended statements were observed to be those teachers making the greatest effort to incorporate the one-to-one computer access into the daily routines, lesson plans, and student activities. These same teachers were the ones completing master's degrees at the university and one teacher who was identified through interview to be clearly constructivist in philosophy and pedagogy.

Teachers in this study were uncomfortable as they attempted to blend their traditional pedagogies with the requirements for teaching in the one-to-one environment. Some of the teachers' biggest concerns were in relation to planning and meeting curricular goals. This can be interpreted as an indication that they were uncomfortable with the prospect of modifying their existing practices and making accommodations for teaching in a one-to-one environment. Observations conducted in the concurrent study confirmed this interpretation as teachers were observed primarily using laptops for word processing and other teacher-centered curriculum activities.

The concerns of the administration are also significant. Administrator B was primarily concerned with gaining a greater understanding of the laptop program. The Awareness and Informational concerns of Administrator B are consistent with one who is currently peripheral to the innovation adoption and joined the school after the program had been initiated (Hall & Hord, 2001). Administrator A who had been involved with the program since its inception was concerned about management of the innovation but also had high level Impact concerns indicating a desire to share the effect of the one-to-one initiative with the immediate and distant community. Concerns of Administrator A were also reflected in comments about making sure there was adequate training for teachers and comments about concern for sustaining the program in the future. Additionally, Administrator A was very involved in the coordinating of rollout sessions in which students got their laptops and as time passed in coordinating the repair and recall of student laptops.

Implications

This study provided a great deal of useful information regarding the teacher concerns in initial adoption and implementation of a one-to-one laptop initiative. The implications have relevance for those considering a one-to-one laptop initiative as well as other innovations. Based upon the findings in this study, three recommendations are offered below. These recommendations are viewed by the researchers as necessary points of emphasis for anyone engaging in similar innovation adoptions.

Alignment of Professional Development and Teacher Concerns

This study found that teachers asked to integrate one-to-one computer access into their classrooms have genuine concerns on different levels. Many of these concerns stem from the teachers' comfort level with the technology and its role in their teaching. It is an important consideration when planning professional development to be aware of teacher concerns. Training and development should be related to teacher concerns if training is going to be meaningful and innovation adoption sustained (Hall & Hord, 2001). Professional development should be in alignment with the stage of concern if innovation adoption is going to be sustained (Dobbs, 2005). Effective professional development should be relevant and meaningful. Professional developers can focus on meaningful content by addressing teacher concerns. As a result of this study, differentiated professional development was recommended to school administration. For example, for the teachers who were concerned about how to integrate technology and meet curriculum standards, the recommendation was put forth that the professional development team focus on promoting student tasks involving technology rather than more complex concepts such as online communication or electronic submission of assignments. Specific recommendations included training on programs and applications as well as general management strategies for one-to-one computing environments. For teachers with management concerns who were worried about taking full advantage of the technology for teaching and learning, it was recommended professional development focus on moving ahead with student-centered technology integration such as having students create multimedia projects. Additionally ongoing training on technology management utilizing electronic communication, online quizzes, and general networking could be provided. This more advanced level of professional development would be overwhelming and intimidating to novices. For those with personal concerns this may act more as an inhibitor to effective use of laptops for learning. In addition, it was recommended training be differentiated based on the specific student population being served (e.g., magnet cohort, classes where 1:1 was not 100% due to students not consistently bringing laptops). As the one-to-one initiative continues, it is recommended that teacher concerns be re-evaluated to not only track changing teacher concerns, but to ensure that professional development continues to be in alignment with concerns.

The professional development recommendations for the school evaluated in this study are worth addressing as the profiles described are likely consistent with other schools in the initial stages of an innovation adoption. Recommended actions for this school take into account the two profiles that were frequently observed as

their needs are different. Another approach would utilize those at more advanced stages working with others through mentoring or sharing activities. However, this particular school already has a team approach to much of the planning process and thus this was not necessary.

Give Teachers a Voice in Innovation Adoption

Too often, teachers who are going through the change process are not consulted on the usefulness of the innovation yet are expected to adopt it with open arms (Richardson & Placier, 2001; Tyack & Cuban, 2000). By acknowledging teacher concerns, change facilitators can support teachers throughout the change process. At a time when teachers are being asked to do more and more to meet state and national standards and concerns such as the No Child Left Behind (NCLB) act requirements, many efforts at innovation adoption are met with resistance.

It is critical that when asked to adopt an innovation teachers feel important and involved. Many teachers at this school shared in one-legged interviews that their attitude toward the laptop program though initially positive waned over time due to factors such as student attitude and uncertainty of the continuation of the program. Teachers' comments illustrate their concerns of not being informed of the programs continuing status. Teachers had concerns about investing large amounts of time into developing new curriculum to only find that next year they would have to go back to a non-laptop environment. It was recommended as a result of this and other concurrent studies at the school site that the program continue yet the teachers be kept informed of all decisions involving the laptop initiative. Other concerns centered on dealing with student apathy toward having laptops "ready" for learning. Students were aware of the consequences for breaking the laptop to the extent that at times this served as an inhibitor to bringing the laptop to school, yet students did not see any consequence for not including laptop preparedness as integral to learning readiness (Donovan, Hartley & Strudler, 2004). It was therefore recommended that teacher concerns about student apathy toward bringing laptops to class be addressed in a program-wide consequence system.

Understanding that Change Is a Process

While the results of this study indicate there are significant levels of self concerns, the data merely provide a snapshot. Simply stated, we are living in a period of significant flux in education. A greater understanding of the change process by all participants should increase the likelihood that projects such as this will be effectively implemented and continued. It was recommended to the administration of this school that they do not get disheartened by the concerns of the teachers during this early phase of the program, yet that they continue to monitor such concerns so they can continue to address them. Teacher buy-in is crucial for sustained innovation implementation (Hall & Hord, 2001) and by acknowledging and addressing feelings of discomfort and teacher concerns through professional development and support, change facilitators can better ensure sustainability of innovations. The results of this study are consistent with concerns that are found in other innovations that are in the early stages. By sharing this type of information with the users, the change facilitator can help those involved see the innovation adoption and implementation as a developmental process rather than an event.

Limitations of Current Study

All studies have limitations and this study is no exception. Limitations of this study lie in participants and setting, and research findings. This study was conducted in a unique setting in that the middle school is in an extremely large school district. More importantly, the selected school site is included in a GEAR UP grant initiative to prepare students from low-income families for college. The student population at this school was considered by their teachers to be less motivated in general when compared to other 7th grade students. This may have impacted teacher concerns about the sustainability and viability of the one-to-one initiative. Similarly, teachers expressed concerns about general school climate in addition to concerns about one-to-one laptop implementation. The number of participants in this study was not extensive and as a result may not be transferable to larger populations. Finally, this study examined teacher concerns during initial implementation of a one-to-one laptop initiative. It does not represent concerns that may have changed as a result of continued implementation.

CONCLUSION

Twenty years have passed since the Apple Classrooms of Tomorrow project first introduced computers to teachers and students on a large scale. Advancements in technology and cost reductions have only recently made such initiatives possible for wide implementation. This rapid increase necessitates an extensive and reasoned evaluation of the one-to-one computing projects (Penuel, 2006). These evaluations should leverage what we know about innovation adoption and utilize the research tools available to gauge not only student outcomes but also process and implementation variables.

The results of this study are largely consistent with previous research in the areas of innovation adoption and more specifically one-to-one computing projects. In terms of innovation adoption in general, participants concerns were largely personal in nature as noted by Hall and Hord (2001) and Newhouse (2001). Similarly, previous studies on one-to-one computing initiatives reported significant teacher concerns related to how their teaching will need to be adapted to effectively utilize the computers (Penuel 2006).

This study has also contributed to an understanding of the critical connection between technology integration and teacher practice. In essence, teachers whose classrooms are more traditional are being asked to adopt two innovations—the one-to-one computing environment and a more student-centered classroom. Rockman and associates noted the gradual shift toward constructivism in the AAL research (1997, 1998, 2000). Zucker (2005) reported that students' self-directed learning increased and the ACOT studies described how the teacher practices were changed (Sandholtz, Ringstaff, & Dwyer, 1997). Prior research implies that the use of technology in some way encourages this shift toward more student-centered or constructivist classrooms. In other words, the technology *causes* the shift. An alternative explanation is that the introduction of a one-to-one computing initiative *requires* a shift toward student-centered practices.

This study provides some insights from the one-legged interviews—particularly with teachers exhibiting more pronounced self level concerns. The teachers'

comments often indicate they are struggling with how they can accommodate a teacher-centered classroom that is populated with student-centered tools. One route the teachers can take is best described by Cuban's (2002) classroom observations that the technology can be added but the learning activities will more or less remain the same. Findings from the current study, however, suggest that focusing on teachers' concerns will likely contribute to more effective professional development and ultimately support changes in teachers' practice in one-to-one computing environments.

Contributors

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APPENDIX

Stages of Concern Questionnaire

The purpose of this questionnaire is to determine the concerns teachers and staff at XXXXXX Middle School have about being part of the Apple Laptop Program. The items in this questionnaire were developed from typical responses of school and college teachers who have been part of educational change and ranged from no knowledge about new technologies to many years of experience with the technology. At this stage, some of the items may be of little relevance or irrelevant to you.

For items that are completely irrelevant, circle 0. Other items will represent those concerns you do have, in varying degrees of intensity, and should be marked higher on the scale—1 being not true of me now to 7 being very true of me now.

For example:

This statement is very true of me at this time.	0 1 2 3 4 5 6 **[7]**
This statement is somewhat true of me now.	0 1 2 3 **[4]** 5 6 7
This statement is not at all true of me at this time.	0 **[1]** 2 3 4 5 6 7
This statement is irrelevant to me.	**[0]** 1 2 3 4 5 6 7

Please respond to items in terms of your *present concerns* or how you feel about being part of the laptop program at XXXXXX Middle School. The results of this questionnaire will be used in the evaluation of the program.

Thank you for your time.

APPENDIX, CON'T

0	Irrelevant	3–4	Somewhat true of me now
1–2	Not true of me now	5–7	Very true of me now

1. I am concerned about students' attitude toward the laptop program	0	1	2	3	4	5	6	7
2. I know of some other approaches that might work better.	0	1	2	3	4	5	6	7
3. I don't even know about the laptop program.	0	1	2	3	4	5	6	7
4. I am concerned about not having enough time to organize myself each day.	0	1	2	3	4	5	6	7
5. I would like to help other faculty in their use of the laptops.	0	1	2	3	4	5	6	7
6. I have very limited knowledge about the laptop program.	0	1	2	3	4	5	6	7
7. I would like to know the effect of the laptop program on my professional status.	0	1	2	3	4	5	6	7
8. I am concerned about conflict between my interests and my responsibilities.	0	1	2	3	4	5	6	7
9. I am concerned about revising my use of the laptop.	0	1	2	3	4	5	6	7
10. I would like to develop working relationships with both our faculty and outside faculty involved in a laptop program.	0	1	2	3	4	5	6	7
11. I am concerned about how the laptop program affects students.	0	1	2	3	4	5	6	7
12. I am not concerned about the laptop program.	0	1	2	3	4	5	6	7
13. I would like to know who will make the decisions in the laptop program.	0	1	2	3	4	5	6	7
14. I would like to discuss the possibility of using the laptops.	0	1	2	3	4	5	6	7
15. I would like to know what resources are available for the laptop program.	0	1	2	3	4	5	6	7
16. I am concerned about my inability to manage all the laptop program requires.	0	1	2	3	4	5	6	7

17. I would like to know how my teaching or administration is supposed to change.	0	1	2	3	4	5	6	7
18. I would like to familiarize other departments or persons with the progress of the laptop program.	0	1	2	3	4	5	6	7
19. I am concerned about evaluating my impact on students.	0	1	2	3	4	5	6	7
20. I would like to revise the laptop program's instructional approach.	0	1	2	3	4	5	6	7
21. I am completely occupied with other things.	0	1	2	3	4	5	6	7
22. I would like to modify our use of the laptops based on the students' experiences.	0	1	2	3	4	5	6	7
23. Although I don't know about the laptop program, I am concerned about other things in the area.	0	1	2	3	4	5	6	7
24. I would like to excite my students about their part in the laptop program.	0	1	2	3	4	5	6	7
25. I am concerned about my time spent working with nonacademic problems related to the laptops.	0	1	2	3	4	5	6	7
26. I would like to know what the use of laptops will require in the immediate future.	0	1	2	3	4	5	6	7
27. I would like to coordinate my efforts with others to maximize the laptop program's effects.	0	1	2	3	4	5	6	7
28. I would like to have more information on time and energy commitments required by the laptop program.	0	1	2	3	4	5	6	7
29. I would like to know what other faculty are doing in this area.	0	1	2	3	4	5	6	7
30. At this time, I am not interested in learning about the laptop program.	0	1	2	3	4	5	6	7
31. I would like to determine how to supplement, enhance, or replace the laptop program.	0	1	2	3	4	5	6	7
32. I would like to use feedback from students to change the laptop program.	0	1	2	3	4	5	6	7

33. I would like to know how my role will change when I am using the laptops. 0 1 2 3 4 5 6 7

34. Coordination of tasks and people is taking too much of my time. 0 1 2 3 4 5 6 7

35. I would like to know how the laptop program is better than what we now have. 0 1 2 3 4 5 6 7

36. What other concerns, if any do you have at this time? (please describe them using complete sentences)

37. Briefly describe your job function.